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(54) **Gas cylinder valve with a connected sensing unit.**

(57) Abstract: The invention is directed to Valve device (2) for a gas cylinder (4), comprising a body (6) with a gas inlet (8), a gas outlet (10) and a passage fluidly interconnecting said inlet (8) and outlet (10); at least a regulating and/or shut-off valve (12) in the passage; a sensing unit (20) mounted on the body (6) and fluidly connected with the passage; an electronic control unit (26); an electrical connection (22, 24) between the electronic control unit (26) and the sensing unit (20); wherein the electrical connection (22, 24) comprises a connector (22) configured for engaging with the sensing unit (20) independently of the relative angular position over a range of at least 20° of said connector (22) on said unit (20). (fig. 1) 93059

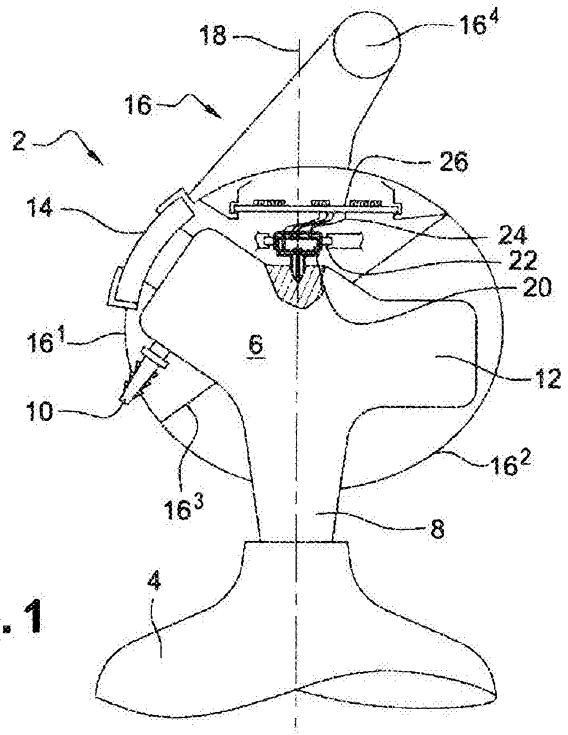

Fig. 1

№93059

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Description

GAS CYLINDER VALVE WITH A CONNECTED SENSING UNIT

Technical field

[0001] The invention is directed to the field of tap or valve devices for compressed gas, more particularly for gas cylinders. More specifically, the invention is directed to such devices with an electronic control unit for computing information relating to the usage of the gas cylinder.

Background art

[0002] Prior art patent document published US 2014/0130875 A1 discloses a valve device to be mounted on a gas cylinder. The device comprises a body with a hand-wheel for adjusting the flow rate that is outputted to an end consumer. The device comprises also a pressure sensor mounted on the body for measuring the inlet pressure, i.e. the pressure in the gas cylinder. It comprises also an electronic control unit that receives information relative to the pressure as well as information relative to the position of the flow selector. Based on these two information, the electronic control unit calculates the amount of gas remaining in the cylinder and also the time remaining until the amount of gas in the cylinder reaches a predetermined level. The electronic control unit is housed in a casing that houses also the pressure sensor and a display. In other words, the pressure sensor, the electronic control unit and the display form a unit that is mounted in one operation on the valve body. Such a construction presents limitations in that it can be not quite practical to have the electronic control unit and the pressure sensor in the same casing. It can indeed be desirable to have the electronic control unit mounted separately. Under such circumstances, both need to be electrically interconnected in a proper manner.

Summary of invention

Technical Problem

[0003] The invention has for technical problem to overcome at least one of the drawbacks of the above cited prior art. More particularly, the invention has for technical problem to provide a solution for electrically interconnecting a

sensing unit that is mounted on a valve device and a corresponding electronic control unit.

Technical solution

[0004] The invention is directed to a valve device for a gas cylinder, comprising: a body with a gas inlet, a gas outlet and a passage fluidly interconnecting said inlet and outlet; at least a regulating and/or shut-off valve in the passage; a sensing unit mounted on the body and fluidly connected with the passage; an electronic control unit; an electrical connection between the electronic control unit and the sensing unit; wherein the electrical connection comprises a connector configured for engaging with the sensing unit, said unit comprising at least one circular electrically conductive track and the connector comprising at least one electrically conductive pin for contacting said track independently of the relative angular position over a range of at least 20° of said connector on said unit.

[0005] The least one circular electrically conductive track can form an arc of circle or a complete circle.

[0006] The range of relative angular position can be of at least 90°. It can also be of 360°. In that case, the least one circular electrically conductive track can form a complete circle.

[0007] The least one circular electrically conductive track can comprise a central disk-shaped track and at least one surrounding track.

[0008] The sensing unit can be a pressure and/or temperature sensing unit.

[0009] The sensing unit is advantageously in direct fluid connection with the inlet, i.e. with the gas in the gas cylinder.

[0010] According to a preferred embodiment, the electrical connection comprises wires or a wire harness connecting the connector to the electronic control unit.

[0011] According to a preferred embodiment, said device further comprises a cover housing the body.

[0012] According to a preferred embodiment, the electronic control unit is separated from the body and housed by the cover.

[0013] According to a preferred embodiment, the connector is attached to the cover.

[0014] According to a preferred embodiment, the connector is attached to the cover with a play in a plane perpendicular to a direction of engagement of the connector with the sensing unit, so as to compensate misalignment between the cover mounted on the body and the sensing unit, said play being preferably comprised between 0.2mm and 5mm, more preferably between 0.5mm and 3mm.

[0015] According to a preferred embodiment, the connector is in abutment with the cover or with the electronic control unit.

[0016] According to a preferred embodiment, the cover comprises several parts assembled together, where two of said parts form two half-shells with contact surfaces to be joined together in an assembling direction which is transversal to said contact surfaces, the assembling direction of the two half-shells corresponding to, or forming an angle of less than 45° with a direction of engagement of the connector with the sensing unit.

[0017] According to a preferred embodiment, the sensing unit comprises a metallic body with a first portion configured for engaging in a gas tight manner with the body and a second portion forming a cavity housing a sensor in fluid connection with the gas and a board with the at least one circular electrically conductive track. The sensor can be a pressure and/or temperature sensor.

[0018] According to a preferred embodiment, the first portion of the body of the pressure sensing unit comprises a thread for the gas tight engagement with the body.

[0019] According to a preferred embodiment, the connector comprises a disk-shaped portion with a periphery and a cylindrical portion extending from said periphery and forming a cavity housing the at least one conductive pin.

[0020] According to a preferred embodiment, the connector comprises, in addition, a circular rib extending outwardly from the periphery of the disk-shaped portion, said rib being configured for engaging with the cover.

[0021] According to a preferred embodiment, the connector is configured such that the cylindrical portion of said connector surrounds the second portion of the body of the sensing unit when said connector is engaged with said unit.

[0022] According to a preferred embodiment, the electronic control unit comprises a printed circuit board.

[0023] According to a preferred embodiment, the electronic control unit is configured for calculating a residual usage time of the gas in the gas cylinder and outputting a signal of said time to a display. The display can be carried by the body and/or by the cover. The display is electrically connected to the electronic control unit.

Advantages of the invention

[0024] The invention is particularly interesting in that it provides a convenient and secure connection between the sensing unit and the electrical control unit. The connection can compensate inherent tolerances in the angular end position of the sensing unit. It can also compensate inherent dimensional tolerances of a cover housing the body. The actual trend for such valve devices is to comprise a cover, a display and electronics for computing information relative to the status of the gas cylinder and the gas consumption. When assembling a valve body equipped with a cover, the connection of the sensing unit can become quite difficult, essentially due to the lack of space between the wall of the cover and the body of the valve device. The connector solution of the present invention greatly facilitates this operation.

Brief description of the drawings

[0025] Figure 1 is a schematic representation of a valve device according to the invention.

[0026] Figure 2 is a sectional view of the pressure sensing unit and the electrical connector of the device of figure 1.

[0027] Figure 3 is a perspective illustration of the circular electrically conductive tracks of the sensing unit of figure 2 and the conductive pins of the connector of figure 2 that interact with said tracks.

Description of an embodiment

[0028] Figure 1 illustrates in a schematic way a valve device in accordance with the invention.

[0029] For instance, the valve device 2 is mounted on the neck of a gas cylinder 4. It comprises a body 6 with a gas inlet 8, a gas outlet 10 and a passage (not represented) interconnecting said inlet 8 and outlet 10. The body can

comprise a pressure reducer 12 and a flow selector 14 operated by a hand-wheel. The pressure reducer 12 and the flow selector 14 are only schematically represented and are well known as such from the skilled person.

[0030] The valve device 2 can also comprise a cover 16 housing at least partially or totally the body 6. For instance, the cover 16 comprises two half-shells 16^1 and 16^2 that are assembled to each other along their mutual contact surfaces 16^3. For instance, these surfaces are inclined relative to the longitudinal axis 18 of the device. They could however be also generally parallel with this axis or alternatively be generally perpendicular to said axis. The upper half-shell 16^1 can comprise or at least support a handle 16^4 for carrying or handling the device 2 and the gas cylinder 4. The cover 16 can however comprise additional elements. In the present case, the cover is generally ball-shaped, being understood that it can take other shapes such as generally cylindrical shape.

[0031] The valve device 2 comprises also a sensing unit 20, for instance a pressure and/or temperature sensing unit 20, electrically connected via a connector 22 and wires or a wire harness 24 to an electronic control unit 26. This latter can be connected to a display (not represented) and be configured for computing the amount of gas remaining in the cylinder 4 and also the time remaining until the amount of gas in the cylinder reaches a predetermined lower level. This computation is essentially based on the pressure at the inlet, i.e. the pressure in the gas cylinder 4 that is measured by the pressure sensing unit 20. Other parameters can also be measured like the temperature of the gas in the cylinder and/or the flow rate of the gas. The computation of such information like the flow-rate, the remaining amount of gas and the remaining usage time is as such well known from the skilled person.

[0032] The electronic control unit 26 can be attached to the cover, for instance to the upper half-shell 16^1. The wires or wire harness 24 can be directly electrically connected to the electronic control unit 26. This latter comprises a printed circuit board. The wires or wire harness 24 is advantageously of a limited lengths and connected at its distal end from the electronic control

unit 26 to the connector 22. This latter is configured for being engaged with the pressure sensing unit irrespective of its angular position relative to said unit, at least over a given angular sector. Indeed, the pressure sensing unit 22 is mounted on the body 6 by a threaded engagement that is usually tightened up to a given torque. Due to manufacturing tolerances, the angular position of the sensing unit tightened at the required torque can vary within a certain range. The connector 22 can be attached to the cover 16, for instance to the upper half-shell 16^1 so that the connector is brought into engagement with the sensing unit 20 when assembling the cover 16 and the valve body 6. For instance, the upper shell 16^1 and the body 6 can be assembled together along the longitudinal direction 18 of the device. Alternatively, the connector 22 can be loose relative to cover 16 or in abutment with said cover 16. During assembly of the device, the connector can therefore be mounted or at least engaged manually and then secured by the cover.

[0033] When the connector 22 is attached to the cover 16, it can have some play in a plane that is perpendicular to the longitudinal axis of said connector. The longitudinal axis of the connector corresponds to the direction of engagement with the sensing unit. In the present case, this axis corresponds to the longitudinal axis 18 of the device. It is however to be understood that these axes can be distinct and can also be not parallel. The play can be comprises between 0.2mm and 5mm, more preferably between 0.5mm and 3mm. It is particularly interesting to have such a play because of the inherent and unavoidable fabrication tolerances of the cover 16.

[0034] Figure 2 is a detailed cross-section view of the sensing unit 20, the connector 22, the wires 24 and the electronic control unit 26.

[0035] The sensing unit 20 comprises a metallic body 28 with a first portion 28^1 configured for engaging in a gas tight manner with the body 6 (figure 1) and a second portion 28^2 forming a cavity 30. The first portion 28^1 is generally elongated with an external thread and a passage for the gas. It can also comprise a seal for a gas tight cooperation with the body. The cavity 30 of the second portion 28^2 houses a sensor 32 in fluid connection with the gas. The sensor 32 comprises a ring-shaped body 32^1 with a passage or cavity

34 in fluid connection with the gas passage in the first portion 28^1 of the body 28. The body 32^1 can be attached in a gas tight manner to the bottom of the cavity 30, e.g. by welding or brazing. The sensor 32 comprises also a membrane 32^2 extending radially in the passage 34 between the upper edges of the ring-shaped body 32^1 so as to form a cavity. The membrane 32^2 is configured to deform elastically under the pressure at the inlet of the device, i.e. the pressure in the gas cylinder. It comprises on its face that is opposed to the gas at least one strain gauges that varies its resistance with the deformation of the membrane. It can also comprise a temperature gauge that changes its resistance with the temperature of the membrane. This or these gauges is/are adhered to the membrane with an adhesive in an electrically insulated manner. The gauge(s) is/are connected to a printed circuit sensor board 36 via wires 38. The sensor board 36 is generally circular with a central hole receiving the sensor 32. The board can comprises electronic components like one or several resistor bridges for providing an output signal that is representative of the measured physical parameter(s).

[0036] The sensing unit 20 further comprises at the opening of the cavity 30 a connecting board 40 that is electrically connected with the sensor board 36 via the connector 42. The connecting board 40 comprises on its external face, i.e. the face opposed to the cavity 30 circular electrically conductive tracks 44 and 46. The track 46 is a central disk-shaped track whereas the tracks 44 are annular track surrounding the central track 46.

[0037] The connector 22 comprises a central disk-shaped portion 22^1 and a cylindrical portion 22^2 extending from the periphery of the disk-shaped portion 22^1. In other words, the connector 22 is generally cap-shaped for engaging with the cylindrical portion 28^2 of the body 28 of the sensing unit 20. The connector 22 can also comprise a seal 22^3 housed in a circular groove formed on the inner surface of the cylindrical portion 22^2. The connector can also comprise a circular rib 22^4 extending radially (relative to the longitudinal axis of the connector) and outwardly. Such a rib can cooperate with abutment and/or attachment means on the cover. The

connector 22 is advantageously made of electrically insulating material, e.g. thermoplastic.

[0038] The connector comprises also electrically conductive contact pins 22^5 attached to the inner side of the disk-shaped portion 22^1. The pins 22^5 extend parallel to the longitudinal axis. Each pin 22^5 contacts a specific track 44 or 46 on the connecting board 40. Each wire 24 is in electrical connection with one of the pins 22^5. The pins 22^5 can be spring loaded so as to be movable along their main directions under a compressive force.

[0039] The connecting board 40 and the electrically conductive pins 22^5 are illustrated in perspective in figure 3. The pins 22^5 can be arranged along a diameter of the connector. As is apparent, the connecting board 40 comprises four tracks, i.e. a central track 46 and three annular and concentric track 44 around the central track 46. As is also apparent in figure 3 the electrical connection between each pin 22^5 and its corresponding track 44, 46 is achieved independently of the relative angular position between the pins 22^5, i.e. the connector 22, and the tracks 44, 46, i.e. the sensing unit 20.

[0040] In the above described embodiment, the sensing unit 20 and the connector 22 comprise four electrical connections. The number of electrical connections can however vary, depending among others on the parameters that are measured.

[0041] Still in the above described embodiment, the tracks 44 form a complete turn, i.e. 360°. The tracks could however also extend only over an angular sector, i.e. form arcs of circle. The tolerances of the end angular position of the sensing unit can indeed by limited to an angle range of less of 360°, i.e. less than 180° or even less than 90°. Consequently, the tracks could extend over about these angular ranges in order to provide an electrical connection despite the above tolerances.

Revendications

1. Dispositif de vanne (2) pour bouteille de gaz (4), comprenant:
   - un corps (6) avec une entrée de gaz (8), une sortie de gaz (10) et un passage interconnectant de manière fluidique ladite entrée (8) et ladite sortie (10);
   - au moins un dispositif de régulation et/ou une vanne d'arrêt (12) dans le passage;
   - une unité de détection (20) montée sur le corps (6) et reliée de manière fluidique avec le passage;
   - une unité de commande électronique (26);
   - une connexion électrique (22, 24) entre l'unité de commande électronique (26) et l'unité de détection (20);

   caractérisé en ce que

   la connexion électrique (22, 24) comprend un connecteur (22) configuré pour venir en prise avec l'unité de détection (20), ladite unité (20) comprenant au moins une piste circulaire électriquement conductrice (44, 46) et le connecteur (22) comprenant au moins une broche électriquement conductrice (22^5) pour venir en contact avec ladite piste (44, 46) indépendamment de la position angulaire relative sur une plage d'au moins 20° dudit connecteur (22) sur ladite unité (20).
2. Dispositif (2) selon la revendication 1, caractérisé en ce que la connexion électrique (22, 24) comprend des fils ou un faisceau de câbles (24) reliant le connecteur (22) à l'unité de commande électronique (26).
3. Dispositif (2) selon l'une des revendications 1 et 2, caractérisé en ce que ledit dispositif (2) comprend en outre une coiffe (16) logeant le corps.
4. Dispositif (2) selon la revendication 3, caractérisé en ce que l'unité de commande électronique (26) est séparée du corps (6) et logée par la coiffe (16).
5. Dispositif (2) selon l'une des revendications 3 et 4, caractérisé en ce que le connecteur (22) est maintenu par la coiffe (16).

6. Dispositif (2) selon la revendication 5, caractérisé en ce que le connecteur (22) est maintenu par la coiffe (16) avec un jeu dans un plan perpendiculaire à une direction d'engagement du connecteur (22) avec l'unité de détection (20), de manière à compenser un défaut d'alignement entre la coiffe (16) montée sur le corps (6) et l'unité de détection (20), ledit jeu étant de préférence compris entre 0,2 mm et 5 mm, plus préférentiellement entre 0,5 mm et 3 mm.

7. Dispositif (2) selon l'une quelconque des revendications 3 à 6, caractérisé en ce que le connecteur (22) est en butée avec la coiffe (16) ou avec l'unité de commande électronique (26).

8. Dispositif (2) selon l'une quelconque des revendications 3 à 7, caractérisé en ce que la coiffe (16) comporte plusieurs parties (16^1, 16^2) assemblées, où deux desdites parties forment deux demi-coques (16^1, 16^2) avec des surfaces de contact (16^3) devant être assemblées entre elles dans une direction d'assemblage qui est transversale auxdites surfaces de contact (16^3), la direction d'assemblage des deux demi-coquilles (16^1, 16^2) correspondant à, ou formant un angle inférieur à 45° avec une direction d'engagement du connecteur (22) avec l'unité de détection (20).

9. Dispositif (2) selon l'une quelconque des revendications 1 à 8, caractérisé en ce que l'unité de détection (20) comprend un corps métallique (28) avec une première partie (28^1) configurée pour être montée de manière étanche aux gaz sur le corps (6) et une seconde partie (28^2) formant une cavité (30) logeant un capteur (32) en liaison fluidique avec le gaz et une plaque (40) avec au moins une piste électriquement conductrice circulaire (44, 46).

10. Dispositif (2) selon la revendication 9, caractérisé en ce que la première partie (28^1) du corps (28) de l'unité de détection (20) comprend un filetage pour le montage étanche aux gaz sur le corps.

11. Dispositif (2) selon l'une quelconque des revendications 1 à 10, caractérisé en ce que le connecteur (22) comprend une partie en forme de disque (22^1) ayant une périphérie et une partie cylindrique (22^2) partant de ladite périphérie et formant une cavité logeant la ou les broches conductrices (22^5).

12. Dispositif (2) selon l'une quelconque des revendications 3 à 8 et selon la revendication 11, caractérisé en ce que le connecteur (22) comprend, en outre, une nervure circulaire (22^4) se prolongeant vers l'extérieur depuis la périphérie de la partie en forme de disque (22^1), ladite nervure (22^4) étant configurée pour venir en prise avec la coiffe (16).

13. Dispositif (2) selon l'une des revendications 9 et 10, et selon l'une des revendications 11 et 12, caractérisé en ce que le connecteur (22) est configuré de telle sorte que la partie cylindrique (22^2) dudit connecteur (22) entoure la deuxième partie (28^2) du corps (28) de l'unité de détection (20) lorsque ledit connecteur (22) est en prise avec ladite unité (20).

14. Dispositif (2) selon l'une quelconque des revendications 1 à 13, caractérisé en ce que l'unité de commande électronique comprend une carte de circuit imprimé (26).

15. Dispositif (2) selon l'une quelconque des revendications 1 à 14, caractérisé en ce que l'unité de commande électronique (26) est configurée pour calculer une durée d'utilisation résiduelle du gaz dans la bouteille de gaz et délivrer un signal dudit temps sur un écran.

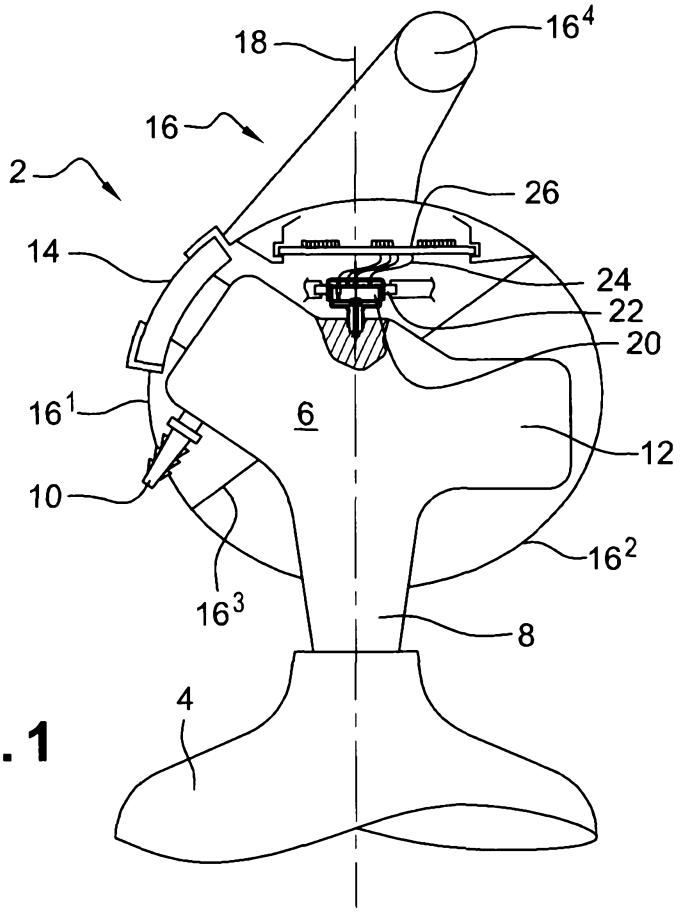

Fig. 1

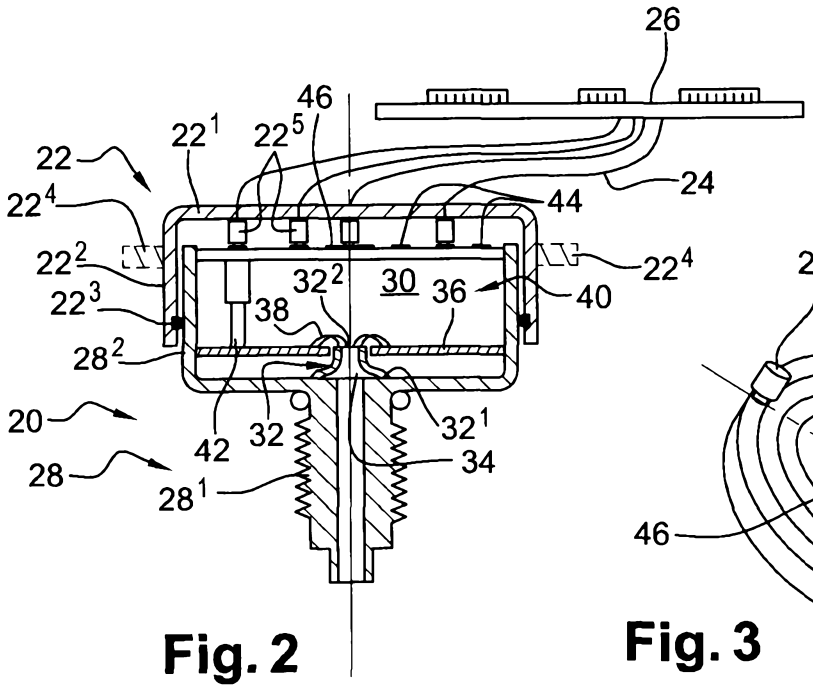

Fig. 2

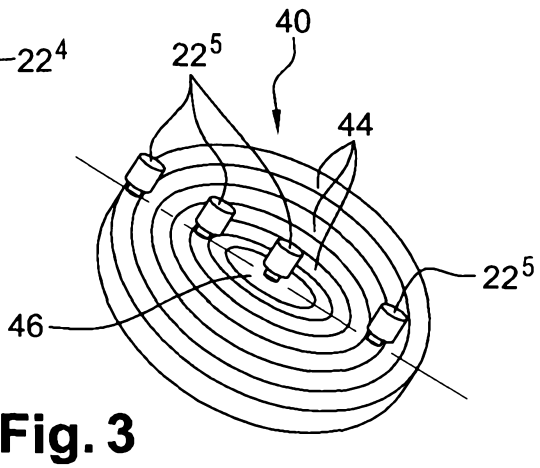

Fig. 3

Abstract

The invention is directed to Valve device (2) for a gas cylinder (4), comprising a body (6) with a gas inlet (8), a gas outlet (10) and a passage fluidly interconnecting said inlet (8) and outlet (10); at least a regulating and/or shut-off valve (12) in the passage; a sensing unit (20) mounted on the body (6) and fluidly connected with the passage; an electronic control unit (26); an electrical connection (22, 24) between the electronic control unit (26) and the sensing unit (20); wherein the electrical connection (22, 24) comprises a connector (22) configured for engaging with the sensing unit (20) independently of the relative angular position over a range of at least 20° of said connector (22) on said unit (20).

(fig. 1)

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SEARCH REPORT

in accordance with Article 35.1 a)
of the Luxembourg law on patents
dated 20 July 1992

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LU 93059

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	EP 2 998 636 A1 (AIR LIQUIDE [FR]; AIR LIQUIDE SANTÉ INTERNATIONAL [FR]) 23 March 2016 (2016-03-23) * paragraphs [0014] - [0034]; figure 2 *	1-15	
A	US 2011/309076 A1 (LIEBENBERG ADRIENNE [GB] ET AL) 22 December 2011 (2011-12-22) * paragraphs [0018] - [0026]; figures 2,3 *	1-15	
A	US 2015/165156 A1 (BATHE DUNCAN P [US] ET AL) 18 June 2015 (2015-06-18) * paragraphs [0034] - [0040]; figure 3 *	1-15	
A	US 2014/130875 A1 (FOWLER ZACHARY [US] ET AL) 15 May 2014 (2014-05-15) * paragraphs [0045], [0048]; figure 3 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) F17C

The present search report has been drawn up for all claims

	Date of completion of the search	Examiner
	24 January 2017	Ott, Thomas

CATEGORY OF CITED DOCUMENTS

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24-01-2017

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		CN 104755829 A	01-07-2015
		EP 2917632 A1	16-09-2015
		KR 20150082288 A	15-07-2015
		PE 09802015 A1	03-07-2015
		US 2014130875 A1	15-05-2014
		US 2016116114 A1	28-04-2016
		UY 35123 A	30-05-2014
		WO 2014074313 A1	15-05-2014

EPO FORM P0457

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie
et du Commerce extérieur

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
LO1357	09.05.2016		LU93059

International Patent Classification (IPC)
INV. F17C13/04

Applicant
LUXEMBOURG PATENT COMPANY S.A.

This report contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

	Examiner
Form LU237A (Cover Sheet) (January 2007)	Ott, Thomas

Application No.
LU93059

WRITTEN OPINION

Box No. I Basis of the opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	1-15
	No:	Claims	
Inventive step	Yes:	Claims	1-15
	No:	Claims	
Industrial applicability	Yes:	Claims	1-15
	No:	Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Box No. VII Certain defects in the application

The following defects in the form or contents of the application have been noted:

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Documents

Closest prior art

D1 WO 2014/125010 A1 (LINDE AG [DE]) 21 August 2014 (2014-08-21)

State of the art

D2 EP 2 998 636 A1 (AIR LIQUIDE [FR]; AIR LIQUIDE SANTÉ INTERNATIONAL [FR]) 23 March 2016 (2016-03-23)

D3 US 2011/309076 A1 (LIEBENBERG ADRIENNE [GB] ET AL) 22 December 2011 (2011-12-22)

D4 US 2015/165156 A1 (BATHE DUNCAN P [US] ET AL) 18 June 2015 (2015-06-18)

D5 US 2014/130875 A1 (FOWLER ZACHARY [US] ET AL) 15 May 2014 (2014-05-15)

OPINION

The invention relates to valves for compressed gas cylinders equipped with a sensor and an electronic control unit connected to that sensor.

Closest prior art WO 2014/125010 A1 discloses such a valve device.

In detail, D1 discloses a valve device for a gas cylinder (see D1, figure 2) , comprising:

- a body (see D1, figure 2, position 4) with a gas inlet, a gas outlet an a passage (see D1, figure 2, position 9) fluidly interconnecting said inlet and outlet,
- at least a regulating and/or shut-off valve (see D1, figure 2, poppet below handle 10) in the passage,
- a sensing unit (see D1, figure 2, position 7) mounted on the body and fluidly connected with the passage,
- an electronic control unit (see D1, figure 2, position 13),
- an electrical connection (see D1, figure 2, position 14) between the electronic control unit and the sensing unit.

The subject-matter of claim 1 **differs from D1** in that the electrical connection comprises a connector configured for engaging with the sensing unit, said unit comprising at least one circular electrically conductive track and the connector comprising at least one electrically conductive pin for contacting said track independently of the relative angular position over a range of at least 20° of said connector on said unit.

The subject-matter of independent claim 1 and thus of its dependent claims 2-15 is consequently **novel**.

The **objective problem** solved by the new features can be defined as allowing a easier electrical interconnection between the sensor and the electronic control unit. Interconnection problems can raise because when the sensing unit is threaded into the valve body, it's angular orientation can vary, so that a precise alignment of the electronic control unit is required.

The solution, consisting of a circular conductive track and an associated pin, allows to be independent from this angular orientation.

In D1, it is an intermediate collar (see D1, figure 2, positon 11) mounted on the neck of the gas cylinder below the protective cover (see D1, figure 2, position 12) that is rotated until the electronic control unit (see D1, figure 2, position 13) is aligned with the sensing unit (see D1, figure 2, position 7). The way the electrical cable connection 8see D1, figure 2, position 14) between both is operated is not detailed, but certainly facilitated because of the alignement.

The subject-matter of independent claim 1 and thus of its dependent claims 2-15 is consequently **inventive**.

Gas cylinders are an **industrial application**.

Re Item VII

Certain defects in the international application (form or content)

Background art

The relevant background art D1 is not mentioned in the description.